

A new species of *Bornia* (Bivalvia: Galeommatoidea) from southern Spain

Una nueva especie de *Bornia* (Bivalvia: Galeommatoidea) del sur de España

Serge GOFAS*

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ABSTRACT

A new species *Bornia aartseni* is described from a shallow soft bottom near Benalmádena, southern Spain. The species is compared to the widespread *Bornia sebetia* (Costa, 1829) and *B. geoffroyi* (Payraudeau, 1826). Hinges and protoconchs are illustrated with scanning electron microscopy. *Bornia sebetia* var. *triangula* (Pallary, 1920), is listed as a synonym and a syntype is figured.

RESUMEN

Se describe una nueva especie *Bornia aartseni* en un fondo blando somero cerca de Benalmádena, sur de España. La especie se compara con las de más amplia distribución, *Bornia sebetia* (Costa, 1829) y *B. geoffroyi* (Payraudeau, 1826). Se ilustran con microscopía electrónica de barrido las charnelas y protoconchas. *Bornia sebetia* var. *triangula* (Pallary, 1920), se considera como un sinónimo de *B. sebetia*, del que se ilustra un sintipo.

INTRODUCTION

The genus *Bornia* comprises small bivalves which are usually found in secluded habitats of the infralittoral zone. The type species, *Bornia sebetia* (Costa, 1829), is widespread in the Mediterranean sea and the genus has been used to accommodate about a dozen species worldwide (WORMS, 2012), some of which very tentatively assigned to the genus.

Four species are hitherto reported from the Mediterranean and Eastern Atlantic (HOEKSEMA AND SIMONS, 2011). Here an additional species found in a coastal environment in southern Spain is described as new.

MATERIALS AND METHODS

Specimens of *Bornia sebetia* from various parts of the Mediterranean, but particularly from the same localities where the new species was collected, were used as comparative material and for a correct orientation of the valves with reference to a complete specimen with soft parts.

Most of the material of the new species was collected during operations for the replenishment of the beach of Benalmádena, province of Málaga, next to the marina. Sand was extracted at the location indicated as type locality by pumping, and delivered to the beach through a pipeline, thereby stranding

* Departamento de Biología Animal, Facultad de Ciencias, Universidad de Málaga, E-29071 Málaga, Spain.

many animals of the infauna. This operation was carried out in June 2003 and again in November 2011. A single valve was collected in shore drift at Calahonda, further to the West on the coast of Málaga.

Selected specimens were cleaned by soaking in 10% solution of sodium lauryl-sulphate and sonicated in water, then dried, mounted on a stub and metallised for examination under the scanning electron microscope.

SYSTEMATICS

Bornia aartseni spec. nov. (Figures 1 A-G, 3 A-C)

Holotype: complete shell, 3.0 mm, in Muséum National d'Histoire Naturelle, Paris (catalogue number: Moll 25155).

Paratypes: complete shell, 2.9 mm; 2 left valves, 3.0 and 2.7 mm; 3 right valves, 2.8, 2.7 and 2.4 mm, all from the type locality, June 2003; complete shell, 2.7 mm, 7 left valves (2.0 to 2.8 mm) and 7 right valves (1.9 to 2.8 mm), all from the type locality, November 2011, in MNHN (catalogue number: Moll 25156); 1 left valve, Calahonda (36° 29.4' N, 04° 41.8' W, 0-1 m), 2.2 mm, in MNHN (catalogue number 25157).

Type locality: Benalmádena Costa, Málaga, Spain (36°35.6'N, 04°30.9'W, 5 m)

Etymology: Dedicated to Jacobus J. van Aartsen (NMNH, Leiden, The Netherlands), who extensively studied this group of microbivalves and had the intuition that this was something different.

Description: Shell up to 3 mm long, subtrigonal in shape with small, prominent umbos, equivalve and equilateral, flattened. Valves completely appressed on all margins, which are smooth and thin. Antero-dorsal margin nearly straight, gradually merging into a rounded anterior margin; postero-dorsal margin slightly convex, also gently merging into the rounded posterior margin; both anterior and posterior margins gradually merging into the slightly convex ventral margin. External surface smooth and glossy, with conspicuous growth lines.

Prodissoconch slightly convex, ovate in outline, 260 to 280 μ m in its greater diameter, delimited from dissoconch by a distinctly incised line. Prodissoconch 1 reaching ca. 100 μ m in its greater diameter; quite distinct, oval-elongate; external surface of prodissoconch 1 slightly rugose, of prodissoconch 2 smooth.

Hinge plate narrow, interrupted under the umbo by a small notch which receives the internal ligament. Left valve with two cardinal teeth (2a and 2b) anterior to the ligament pit, the most anterior one elongate and nearly parallel to the antero-dorsal margin, the posterior one small, narrow and oriented vertically;

posterior to the ligamental pit is a strong lateral tooth (PII), elongate and parallel to the postero-dorsal margin. Right valve with a strong, very oblique cardinal tooth (1) anterior to the ligamental pit, pointing towards an antero-ventral direction and overhanging the edge of the cardinal platform; posterior to the ligamental pit is one very strong and thick lateral tooth (PI) nearly parallel to the postero-dorsal margin and also overhanging the edge of the platform. The anterior tooth of the right valve seems compound, with a thicker segment close to the umbo pointing downwards, and a thinner distal part pointing forwards.

Interior of valves smooth, with muscle scars and pallial line usually very distinct due to more transparency of the shell material. Muscle scars proportionally very small with a diameter in the order of 1/10th of the shell length. Pallial line thick, starting from the muscle scars and running quite close to the shell margin, the distance between the outer edge and the ventral margin being about 1/8th of shell height. On the posterior side, the pallial line makes an inflexion inwards just below the muscle scar. The surface within the pallial line has a frosty appearance.

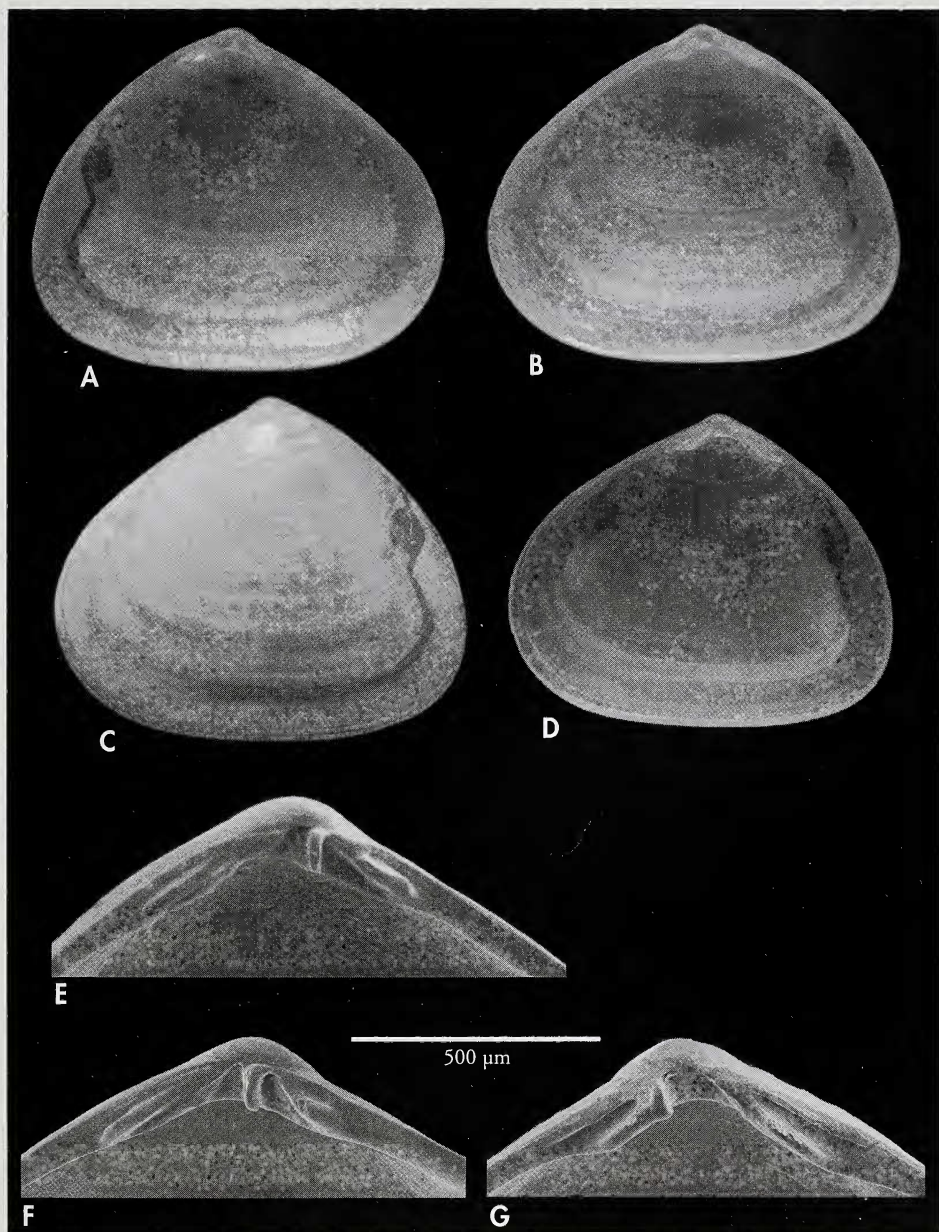


Figure 1. *Bornia aartseni* spec. nov. A, B: interior of left and right valves of the holotype from Benalmádena, actual length 3.0 mm; C: exterior of the left valve of the holotype; D: interior of the right valve of a bivalved paratype from Benalmádena, actual length 2.9 mm; E: hinge of a left valve from Calahonda; F: hinge of a left valve from Benalmádena; G: hinge of a right valve from Benalmádena.

Figura 1. *Bornia aartseni* spec. nov. A, B: interior de las valvas izquierda y derecha del holotipo, Benalmádena, longitud real 3,0 mm; C: exterior de la valva izquierda del holotipo; D: interior de la valva derecha de un paratipo bivalvo, Benalmádena, longitud real 2,9 mm; E: charnela de una valva izquierda, Calahonda; F: charnela de una valva izquierda, Benalmádena; G: charnela de una valva derecha, Benalmádena.

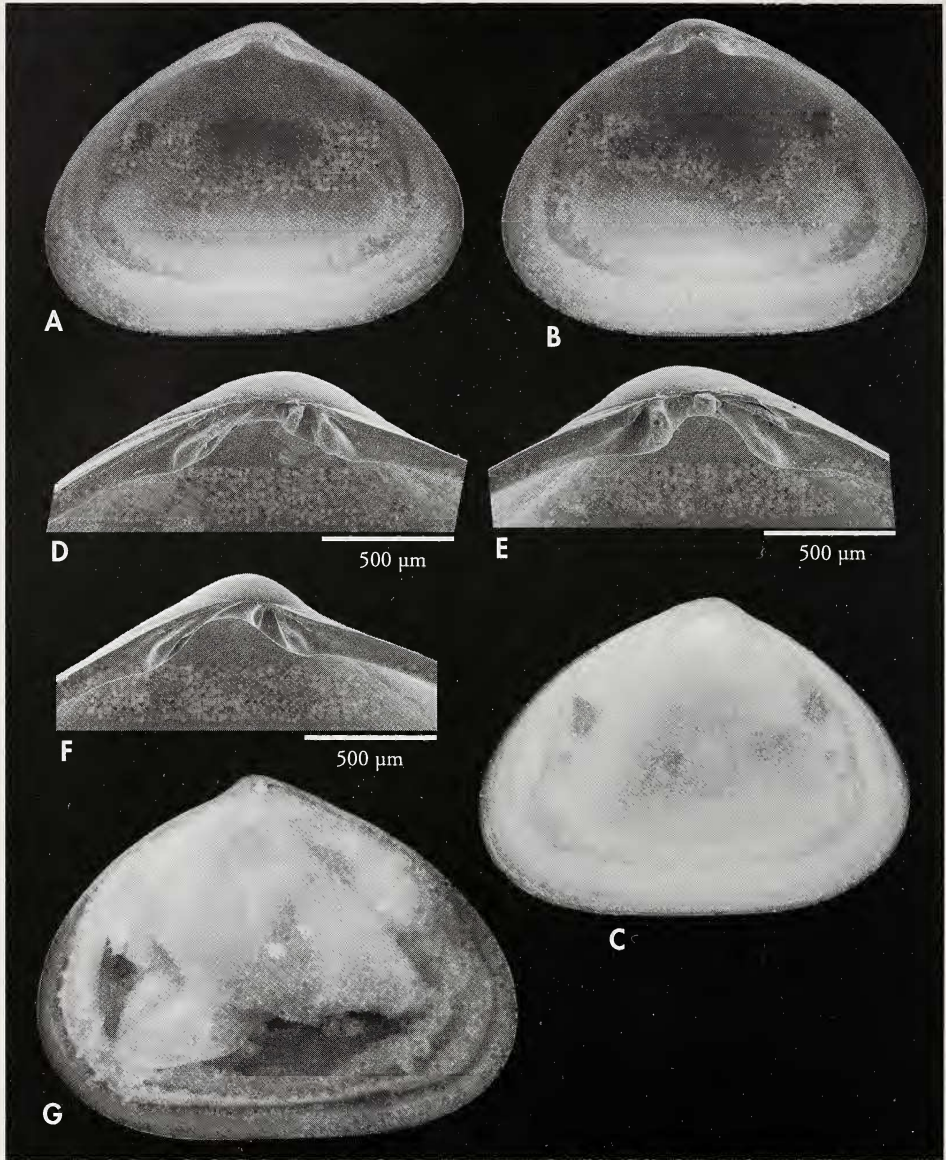


Figure 2. *Bornia sebetia* (Costa, 1829). A, B: interior of left and right valves of a specimen from Calahonda, actual length 4.2 mm; C: exterior of the right valve of the same specimen; D, E: hinge of the left and right valves of the same specimen; F: hinge of a left valve from Benalmádena; G: inside of a preserved specimen from Benalmádena, viewed from the left side with left valve and mantle lobe removed, showing the anterior tongue-like foot and the two developed demibranchs. The small spots in the mantle cavity are brooded embryos at an early stage of development.

Figura 2. *Bornia sebetia* (Costa, 1829). A, B: interior de las valvas izquierda y derecha de un ejemplar de Calahonda, longitud 4,2 mm; C: exterior de la valva derecha del mismo ejemplar; D, E: charnela de las valvas izquierda y derecha del mismo ejemplar; F: charnela de una valva izquierda de Benalmádena; G: interior de un ejemplar de Benalmádena, visto desde el lado izquierdo con valva izquierda y el lóbulo del manto eliminados, mostrando el pie anterior en forma de lengua y las dos hemibranquias desarrolladas. Las manchas pequeñas en la cavidad del manto son embriones incubados una etapa temprana de desarrollo.

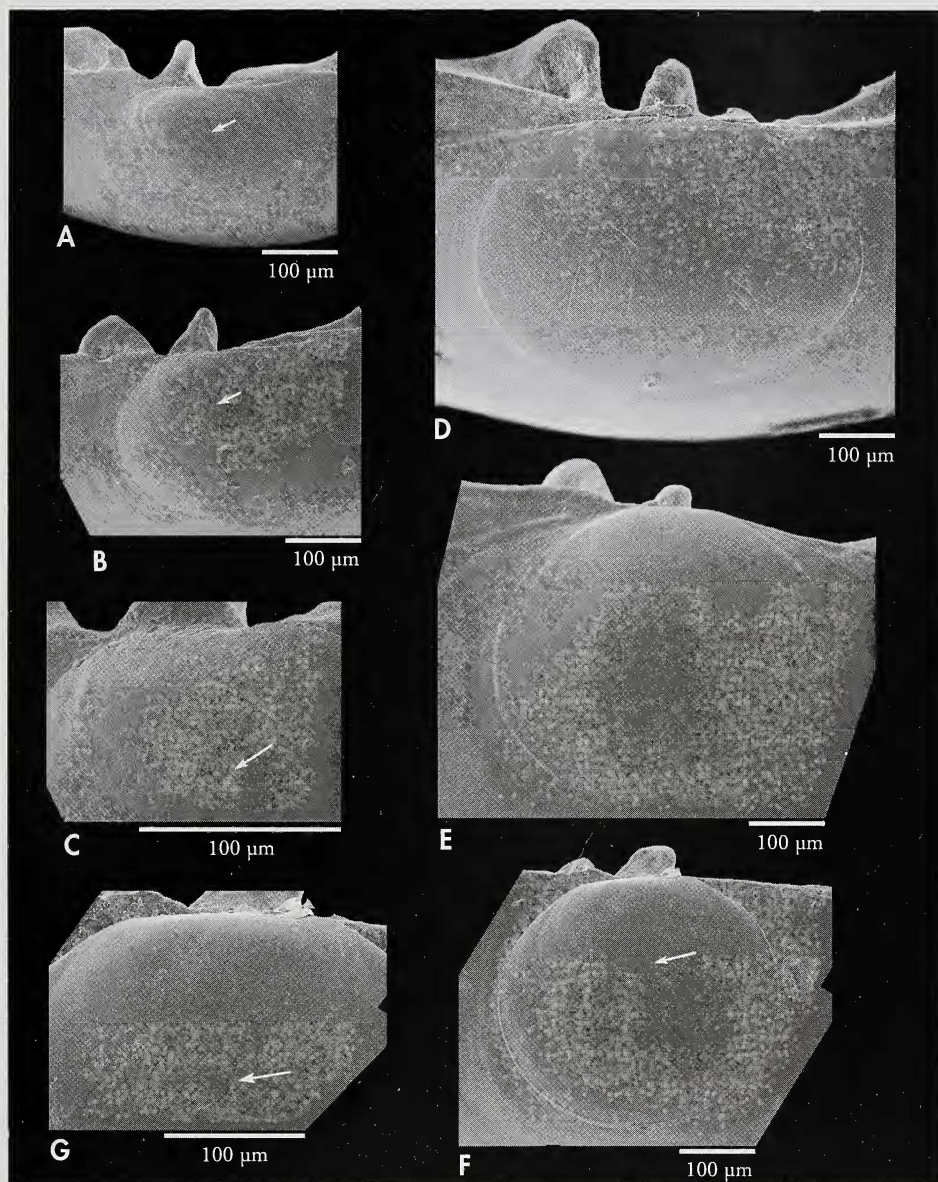


Figure 3. Prodissoconchs of *Bornia* spp. A: *Bornia aartseni* spec. nov. from Calahonda, same valve as figure 1E; B: *Bornia aartseni* spec. nov. from Benalmádena, same valve as figure 1F; C: enlarged view of prodissoconch 1 of the same valve; D: *Bornia sebetia* (Costa, 1829), left valve from Calahonda, viewed with ventral margin tilted backwards; E: *Bornia sebetia*, left valve from Benalmádena; F: *Bornia geoffroyi* (Payraudeau, 1826), right valve from Calahonda; G: enlarged view of prodissoconch 1 of the same protoconch. Arrows show the transition from prodissoconch 1 to prodissoconch 2.

Figura 3. Prodissoconchas de *Bornia* spp. A: *Bornia aartseni* spec. nov. de Calahonda, misma valva que la figura 1E; B: *Bornia aartseni* spec. nov. de Benalmádena, misma valva que la figura 1F; C: vista ampliada de la prodissoconcha 1 de la misma valva; D: *Bornia sebetia* (Costa, 1829), valva izquierda de Calahonda, vista con el margen ventral inclinado hacia atrás; E: *Bornia sebetia*, valva izquierda de Benalmádena; F: *Bornia geoffroyi* (Payraudeau, 1826), valva derecha de Calahonda; G: vista ampliada de la prodissoconcha 1 de la misma valva. Las flechas señalan la transición de prodissoconcha 1 a prodissoconcha 2.



Figure 4. The figured syntype of *Bornia sebetia* var. *triangula* (Pallary, 1920), a left valve from Mazagan (now El Jadida, Atlantic coast of Morocco), in Muséum National d'Histoire Naturelle, Paris (catalogue number: Moll 25158). Actual length 6.0 mm.

Figura 4. El sintipo de *Bornia sebetia* var. *triangula* (Pallary, 1920), de Mazagan (ahora El Jadida, costa atlántica de Marruecos), en el Museo Nacional de Historia Natural de París (número de catálogo: Moll 25158). Longitud real 6,0 mm.

Discussion: The homology of hinge teeth in the Galeommatoida is far from being straightforward, and the above description follows the interpretation of CHAVAN IN MOORE (1969) of the teeth situated in front of the ligamental pit as cardinals (2a and 2b on the left valve, 1 on the right valve) and of those situated behind it, as laterals (PII on the left valve, PI on the right valve). This is also the interpretation followed by HOEKSEMA AND SIMONS (2011) in their description of the Canarian species. It is however debatable whether the most anterior tooth could be considered as an anterior lateral, or even as a compound tooth where only the distal part would be homologous to a lateral, as suggested by the morphology seen on figure 1G. It is far beyond the scope of this paper to reassess the homology of teeth, which would need access to large ontogenetic series in many species.

This new species was figured by VAN AARTSEN (1997: 44, fig. 30) as *Bornia sebetia* var., represented by two valves 2,6 mm in length and proceeding from the area of Malaga.

Bornia sebetia (Costa, 1829) is the most similar species. The name was ori-

ginally made available in the caption of a figure (COSTA, 1829:131; pl. 2 fig. 6), and the species was described only ten years later (COSTA, 1839: 190-191). It was believed by COSTA (1839) to be a freshwater species, with a type locality "foci del Sebetu" (mouth of the river Sebetus, in the eastern part of downtown Naples). This was the reason for which PHILIPPI (1836: 14) dismissed the name, although he was aware of it, and redescribed the species as *Bornia corbuloides*. The latter name was universally used until BUCQUOY, DAUTZENBERG AND DOLLFUS (1892: 236) restored the specific name *sebetia*, now in usage, on the grounds of priority. *Bornia corbuloides* is type species of the genus by subsequent designation (STOLICZKA, 1871: 266).

Compared to *Bornia aartseni* spec. nov., *Bornia sebetia* is considerably larger (more than twice), and has much more rounded, less prominent umbos. The prodissoconch is in proportion almost twice as large (450-500 μ m). The hinges are also different, although they have the same general setting of the genus. On the left valve, the rather small tooth immediately anterior to the ligamental

pit, convincingly interpreted as a cardinal tooth (2b), is vertical in *Bornia aartseni* spec. nov. and pointing towards posterior in *B. sebetia*; the anteriormost tooth, interpreted as an anterior cardinal (2a) following HOEKSEMA AND SIMONS (2011), is narrow and nearly parallel to the antero-dorsal margin in *Bornia aartseni* spec. nov., thick and pointing downwards in *B. sebetia*. On the right valve, both teeth are considerably narrower and more parallel to the margins in *Bornia aartseni* spec. nov. than in *B. sebetia*. The pallial line is situated proportionally much closer to the ventral margin in *Bornia aartseni* spec. nov. than in *B. sebetia*, it is less ragged on its inner edge and starts from the muscle scars proper, not somewhat outwards like in *B. sebetia*. The inner surface of *B. sebetia* shows faint radial lines, backed by inner structures of the shell, whereas the inner surface of *Bornia aartseni* spec. nov. has a frosty, non-lined surface.

Kellya (Bornia) sebetia var. *triangula* Pallary 1920 (p. 84, pl. 1 fig. 21) is based on a very worn left valve (Figure 4) from Mazagan (now El Jadida, Morocco). This specimen is proportionally higher than typical *Bornia sebetia*, but otherwise fits the size range and hinge characters of this species, as described above. It may be a specimen with abnormal growth and, unless further

collecting reveals a separate species with these proportions on the Atlantic coast of Morocco, should be maintained in the synonymy of *Bornia sebetia*.

Bornia canariensis Hoeksema and Simons, 2011, described from the island of Gran Canaria, is markedly smaller (less than half the size of *Bornia aartseni* spec. nov.) and yet has a proportionally thicker hinge plate. On the left valve, the tooth situated posterior to the ligament is parallel to the postero dorsal margin in both species, but not so much on the right valve where it is more like *B. sebetia* than like *Bornia aartseni* spec. nov.

Other species reported in the area are considerably different and may even not be congeneric. *Bornia geoffroyi* (Payraudau, 1826), placed in the genus *Semeloidea* Bartrum & Powell, 1928 by CHAVAN (1969) and VAN AARTSEN (1997), is considerably larger (up to 15 mm) and flatter, has anteriorly to the ligament very short cardinal teeth pointing downwards, two on the left valve and one on the right valve; posterior to the ligament each valve bears one very long posterior tooth nearly parallel to the postero-dorsal margin. *Bornia balalaika* Cosel, 1995 has a distinctive outline in which anterior and posterior margins make a right angle with the ventral margin, and is described as having two cardinal teeth on each valve (VON COSEL, 1995).

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